Testing Differential OTF and Phase Apodization Coronagraphy
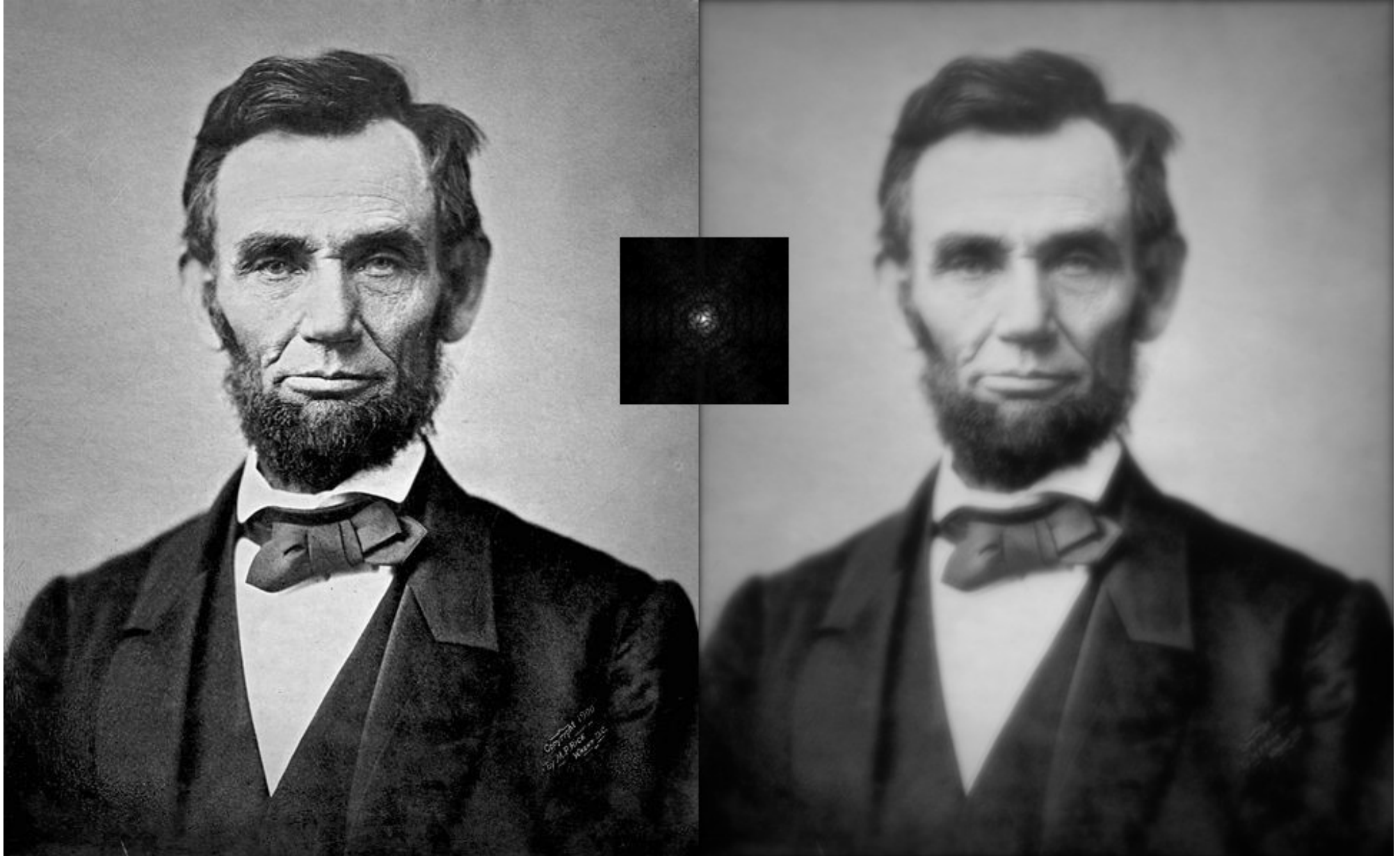
Johanan L. Codona

Steward Observatory

University of Arizona
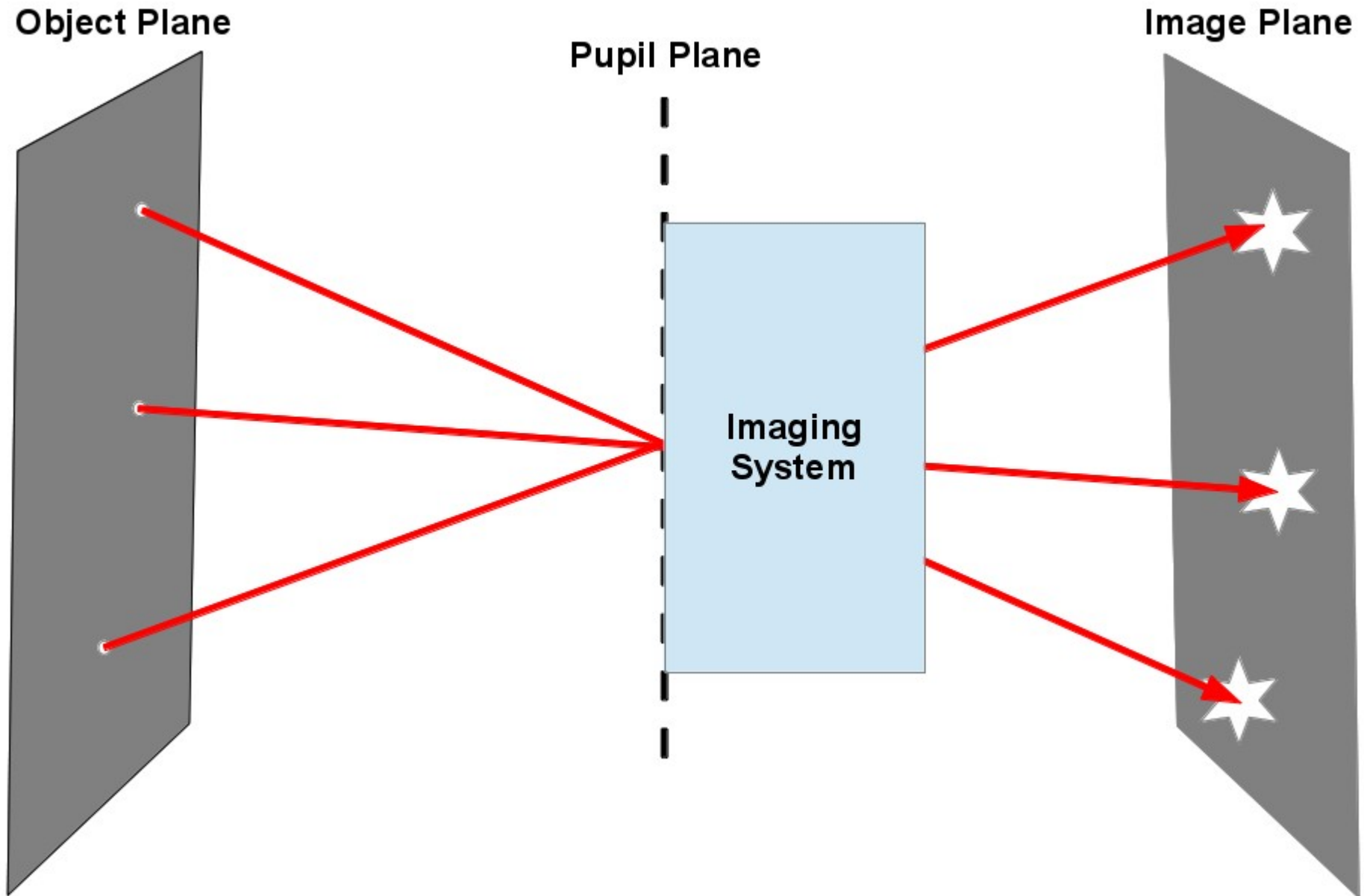
CAAO

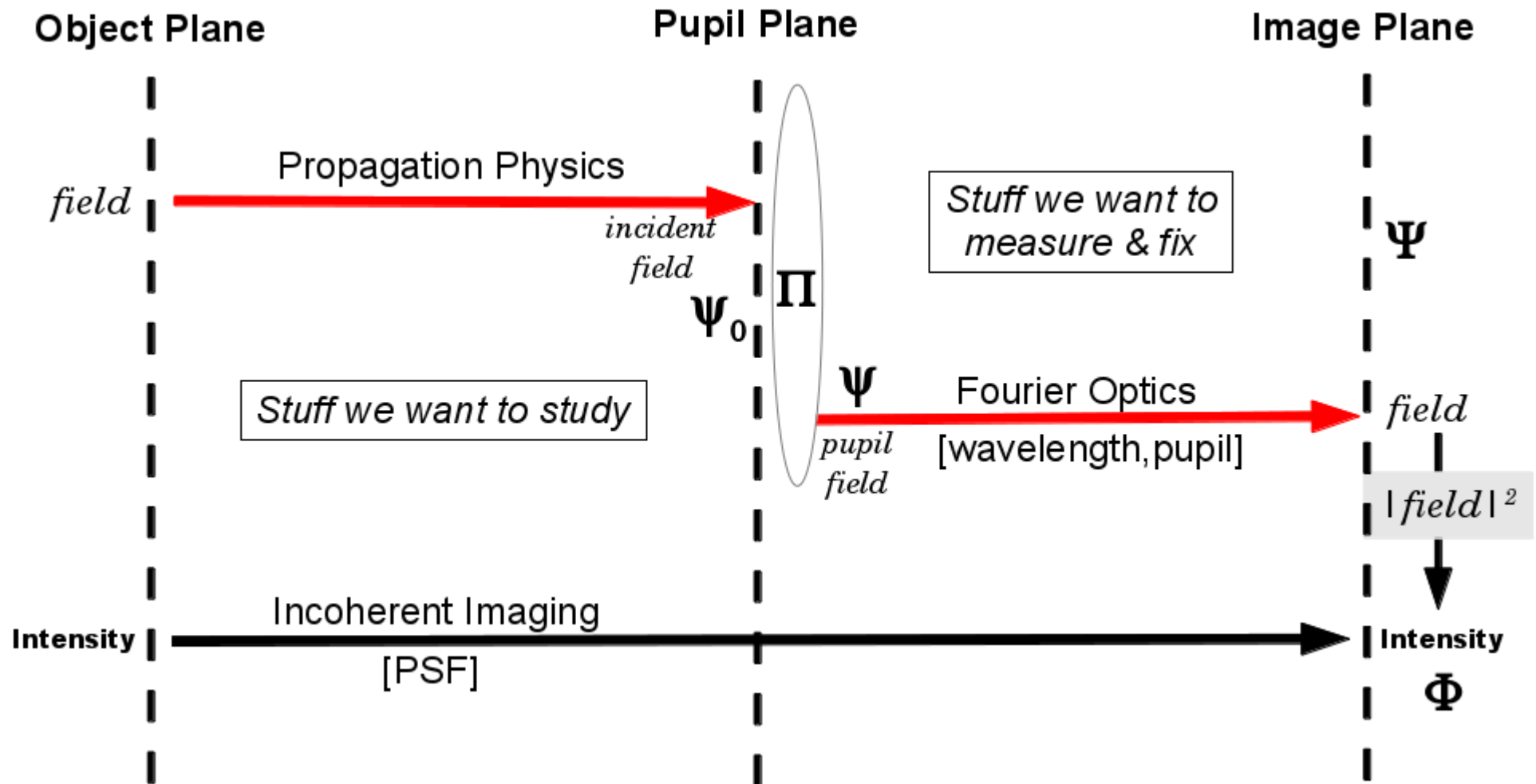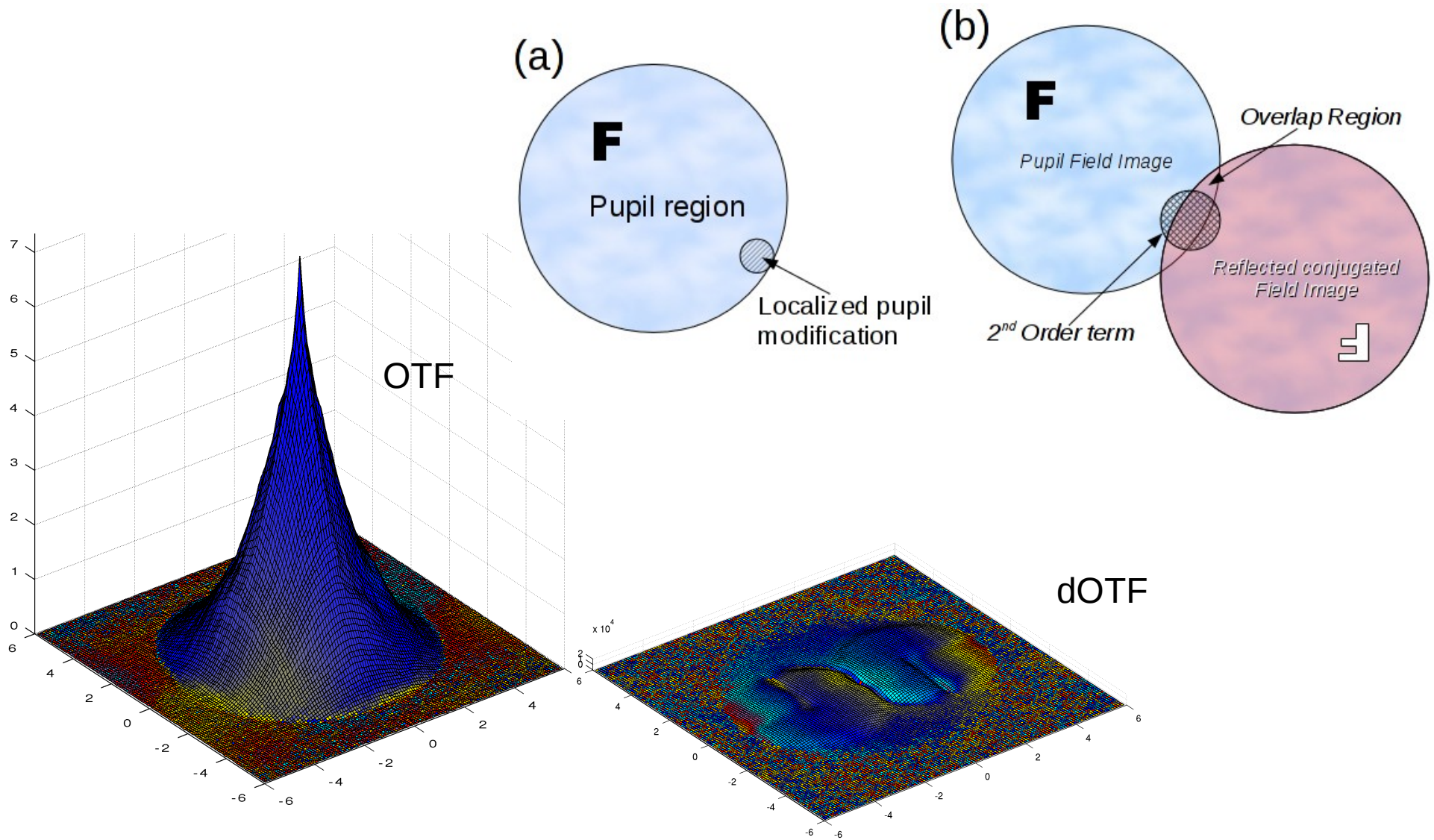Center for Astronomical Adaptive Optics

Incoherent Imaging
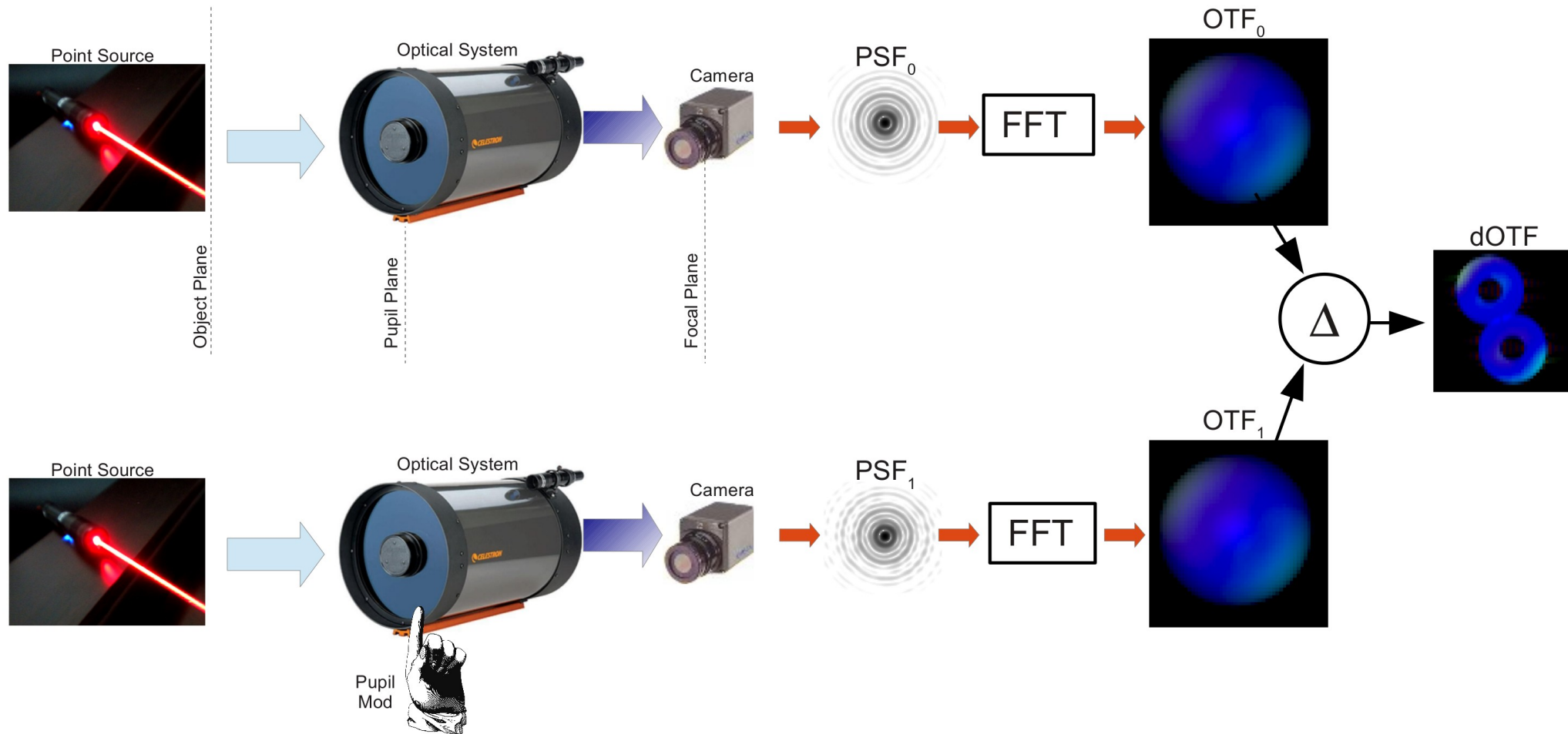## (Convolving with a PSF)

Simplified View of Incoherent Imaging

Fourier Optics vs. Incoherent Imaging

Differential OTF

(a) Pupil region

F

Localized pupil modification

(b)

F

Pupil Field Image

Overlap Region
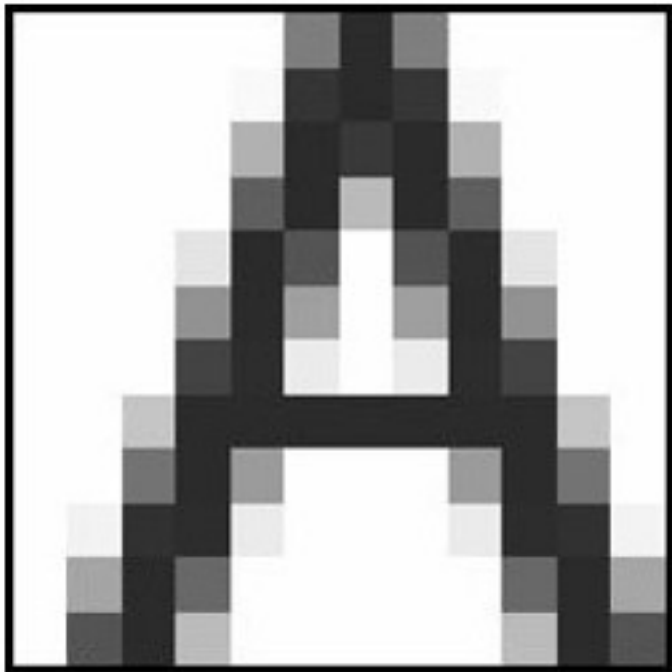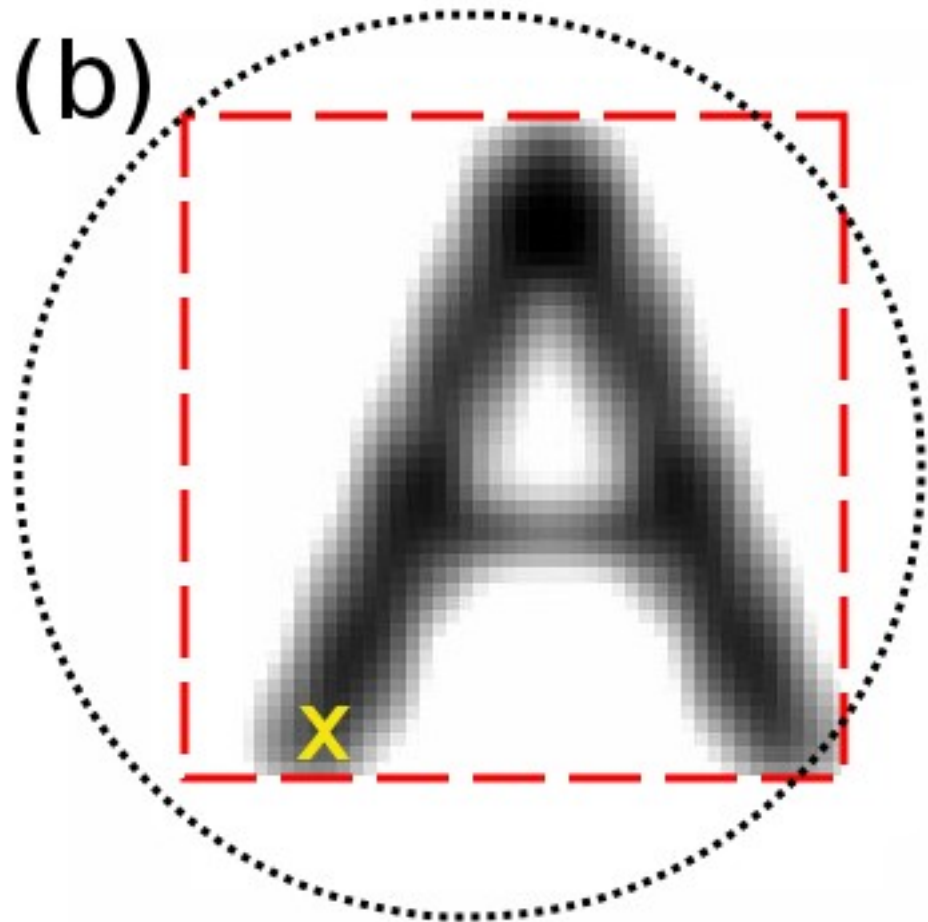
2nd Order term

Reflected conjugated Field Image

OTF

dOTF

x 10⁴

Differential OTF in Practice

A Differential OTF Experiment

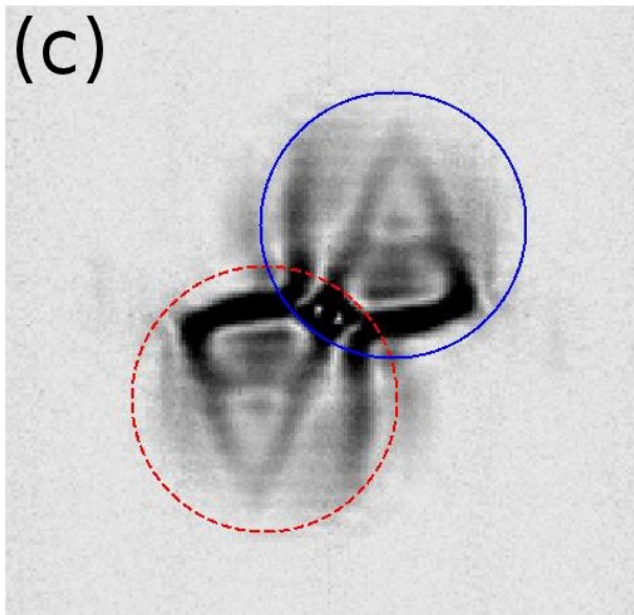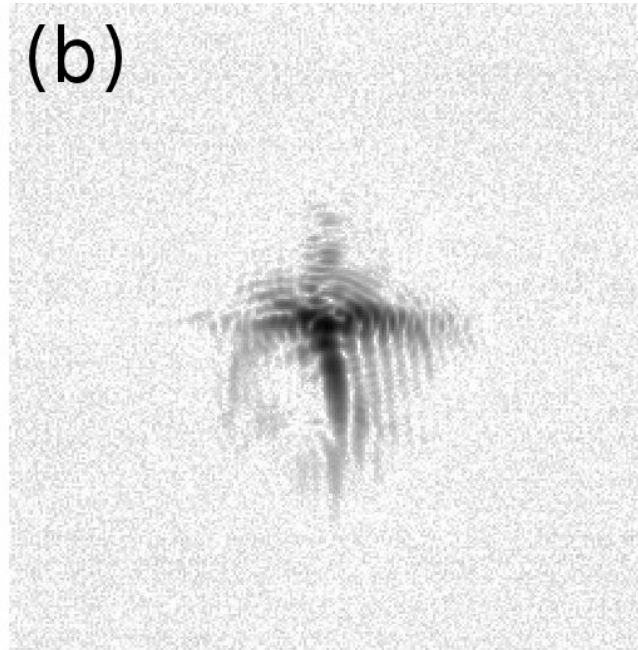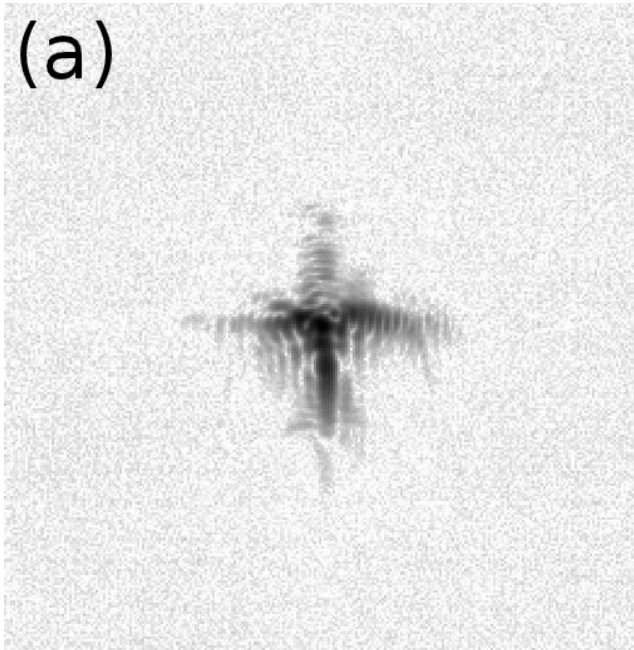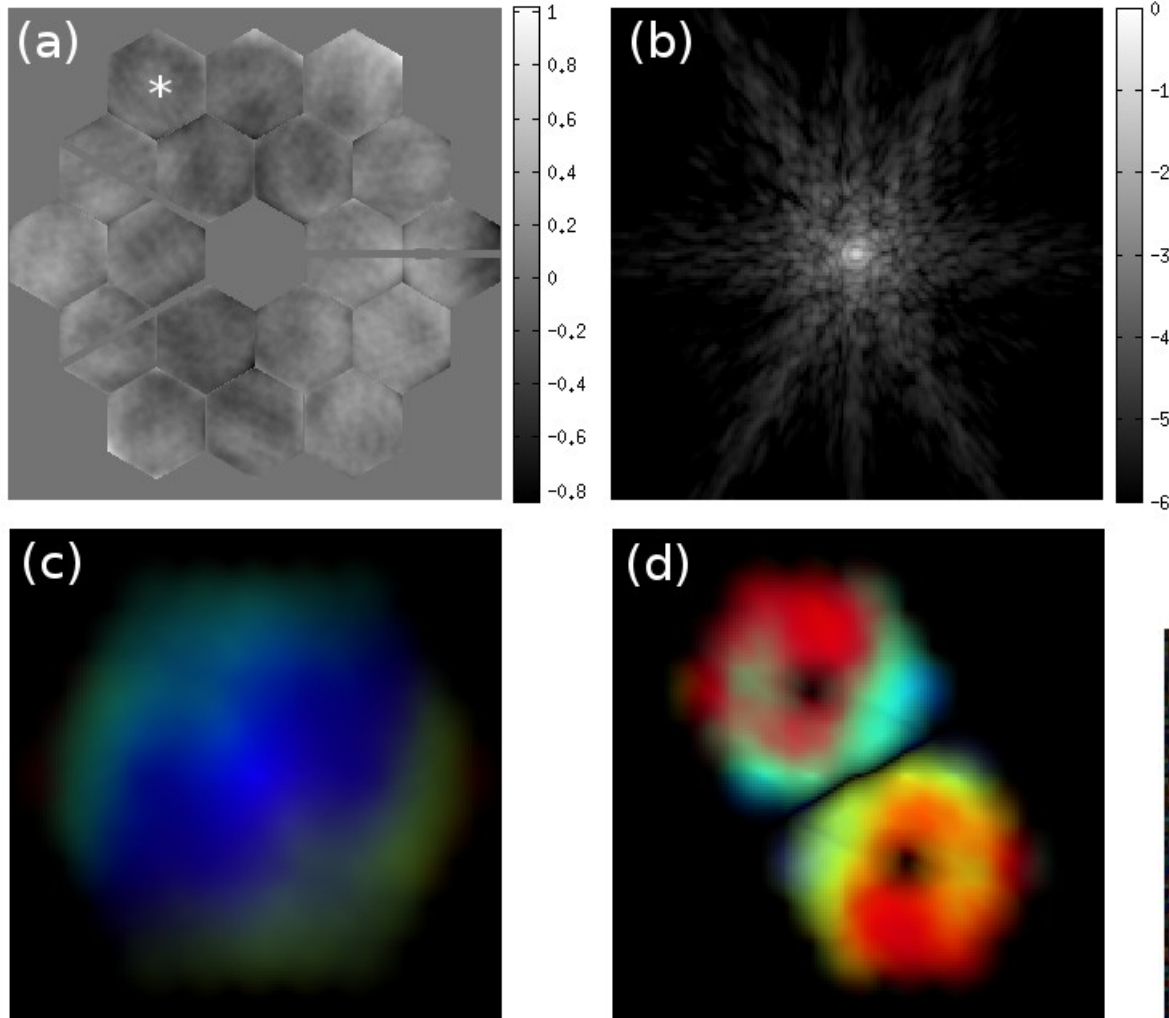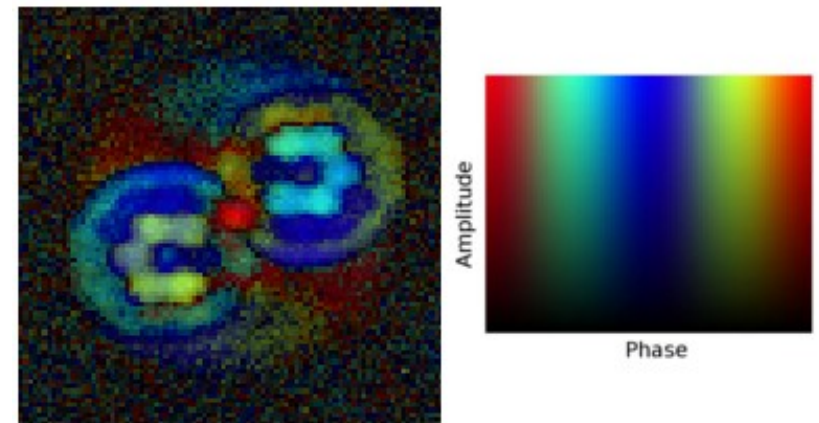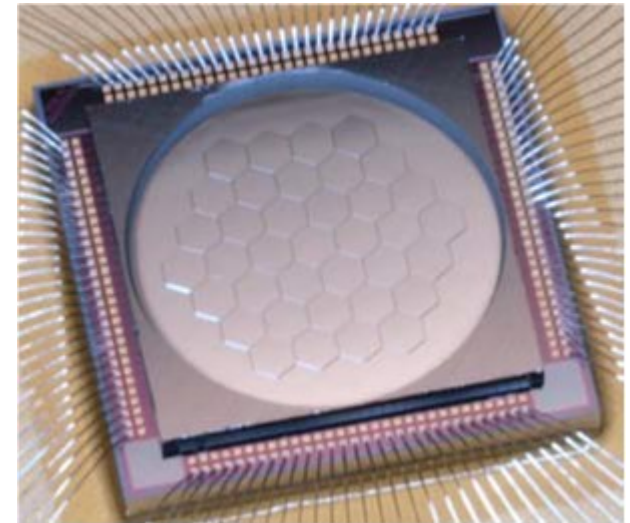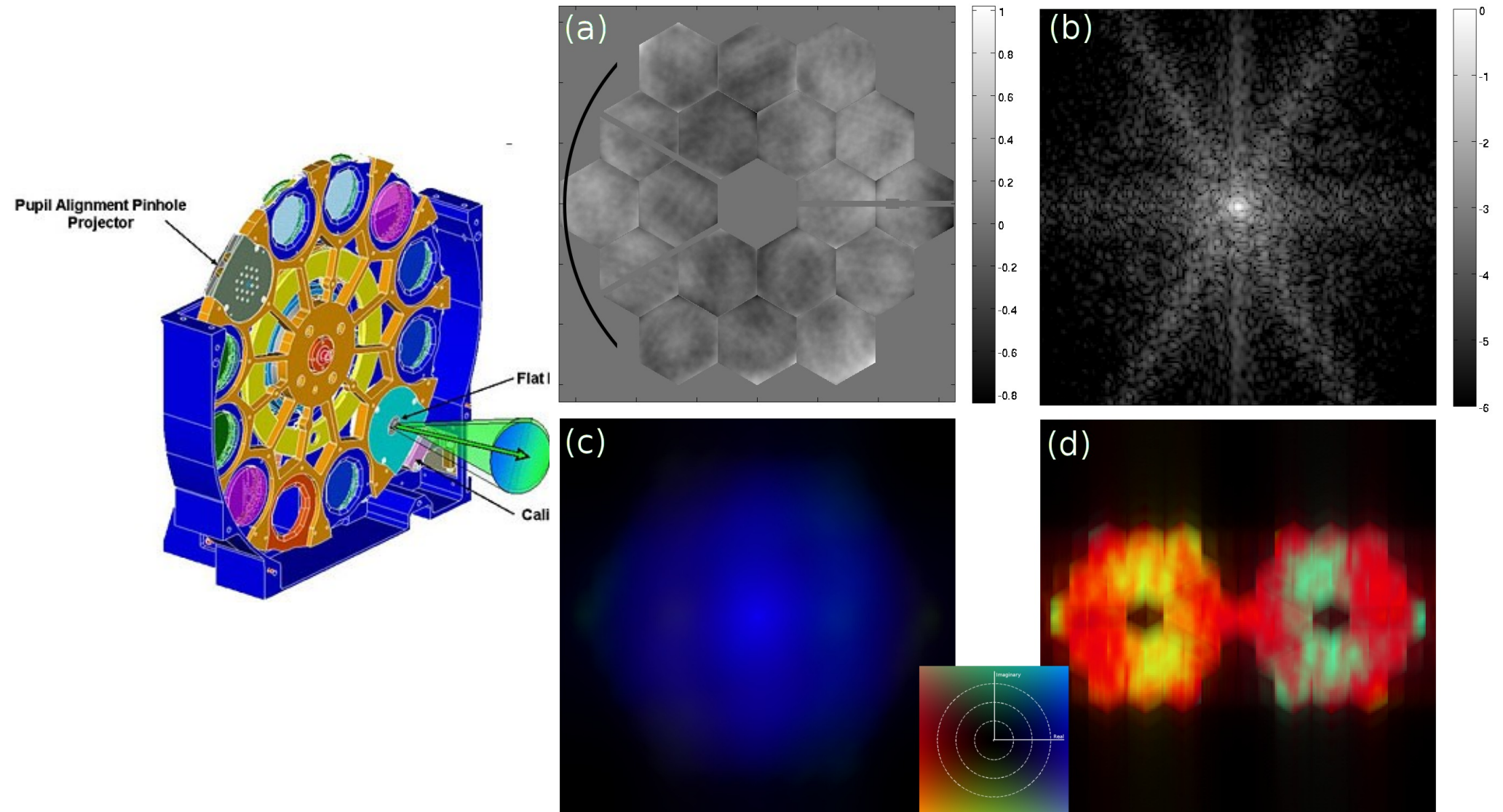# Experimental Results
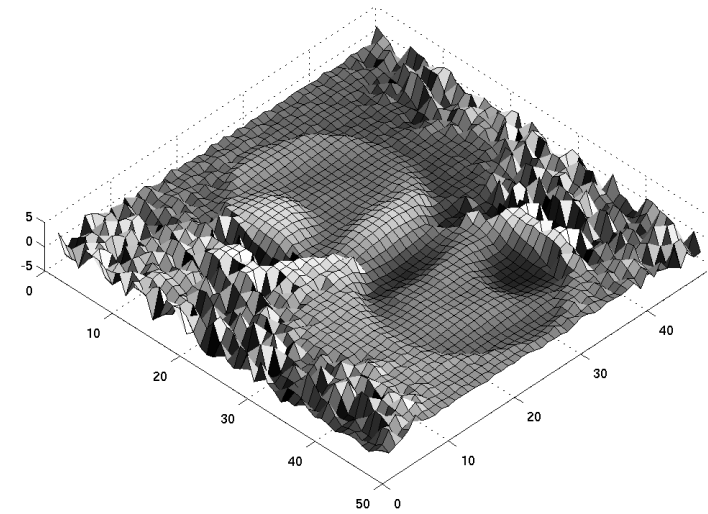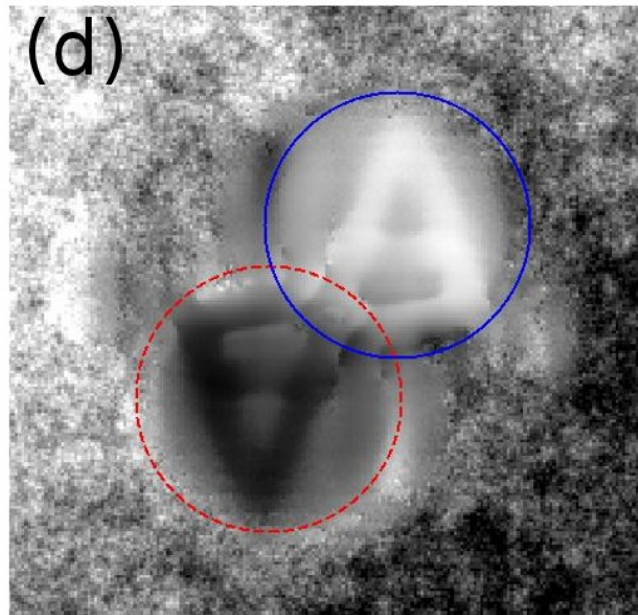
Exploring dOTF for JWST Segment Phasing

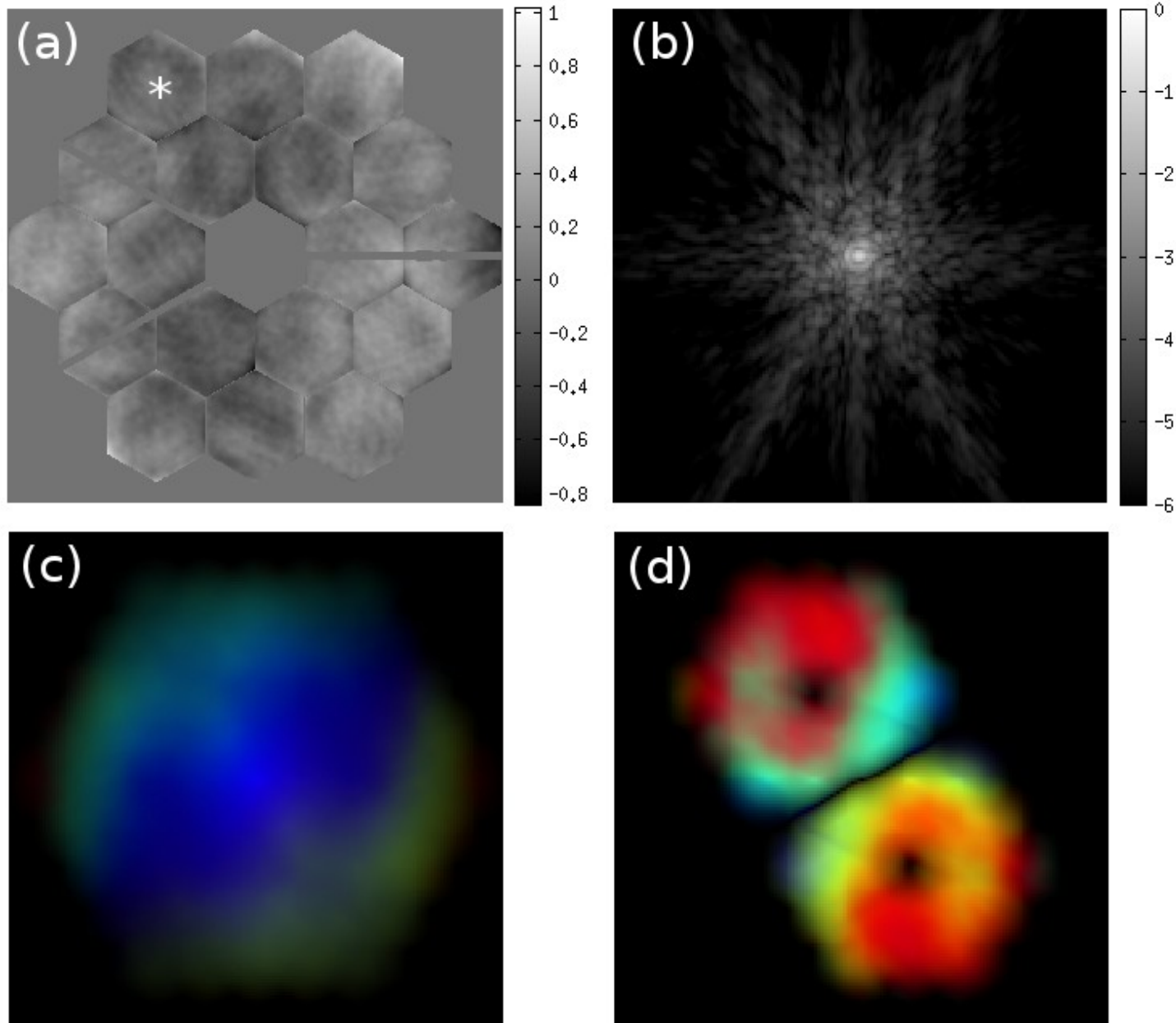Simulated JWST measurement using
one segment actuator and two star images
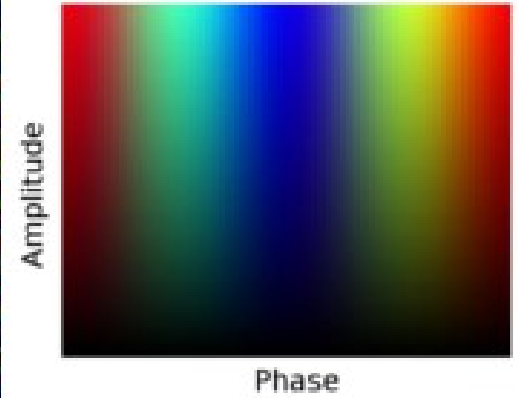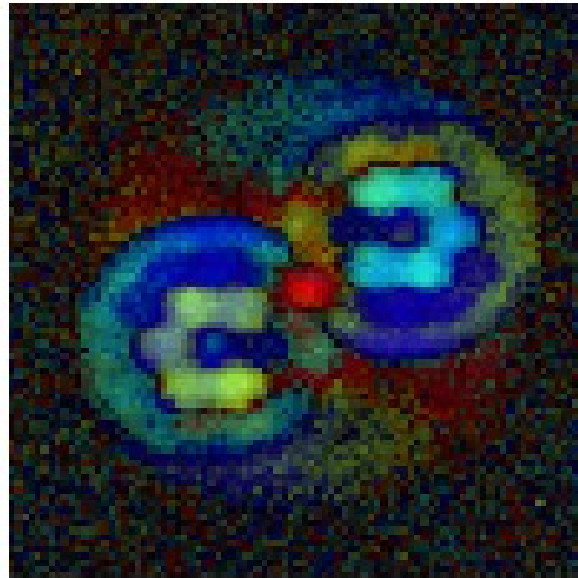
Segmented mirror
experiment using an
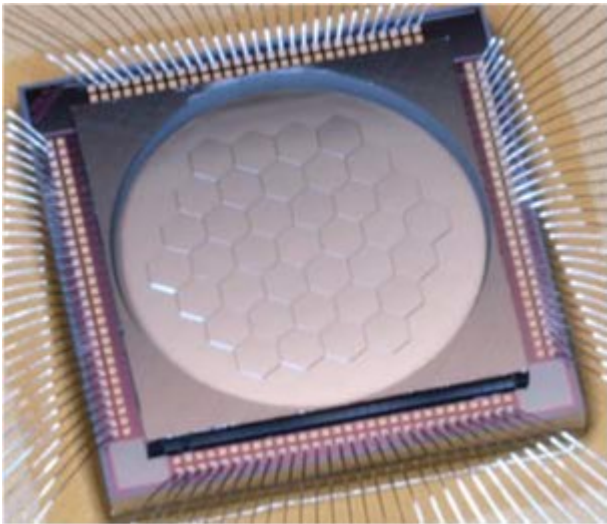Iris AO MEMS DM.
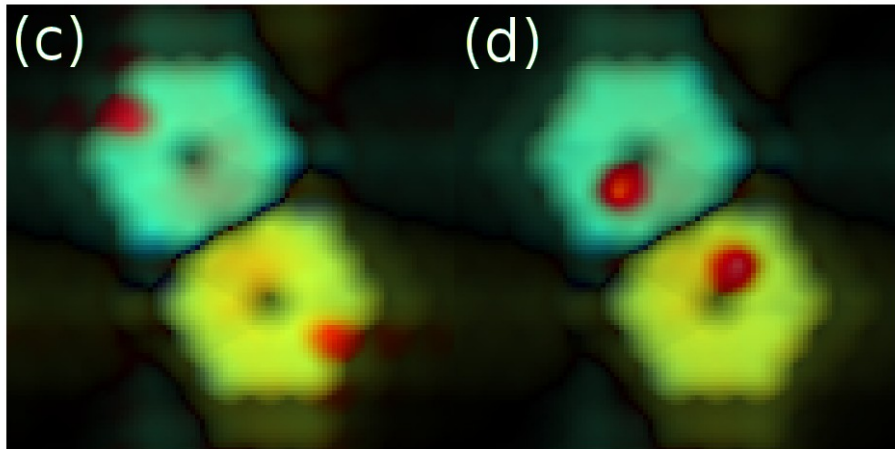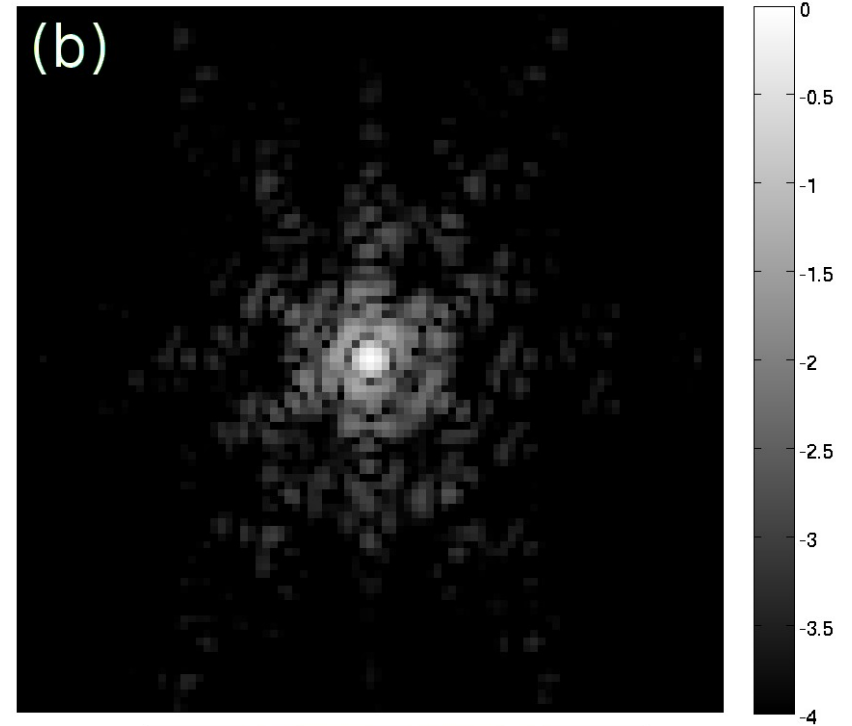
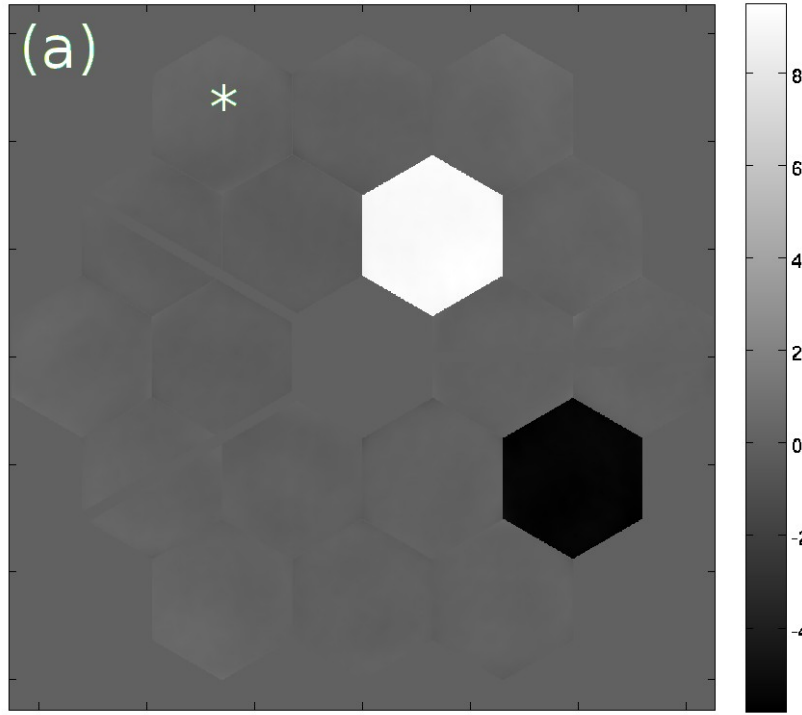# JWST dOTF using a Misaligned Filter Wheel

JWST dOTF using a Segment

Lab Experiment for Segment dOTF

Iris AO PTT DM

Amplitude

Phase

Large Capture Ranges
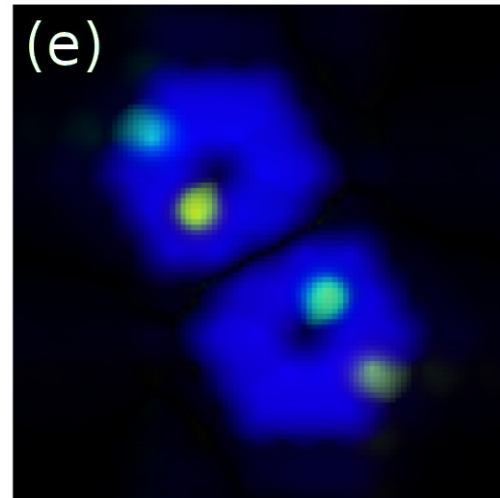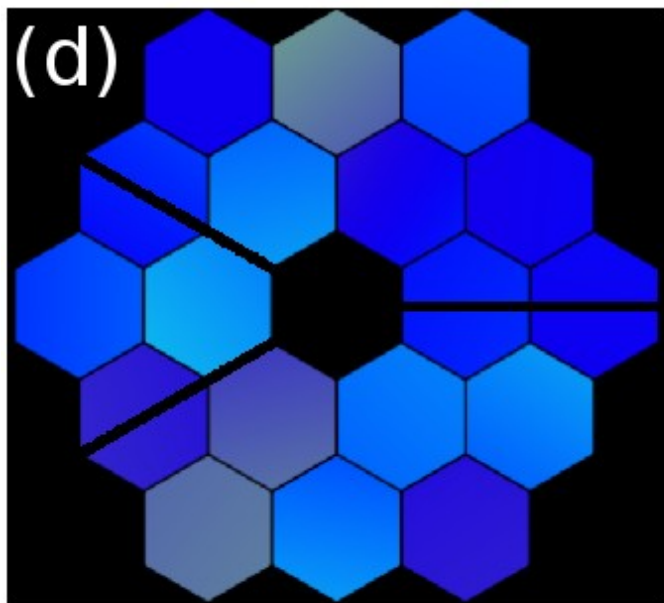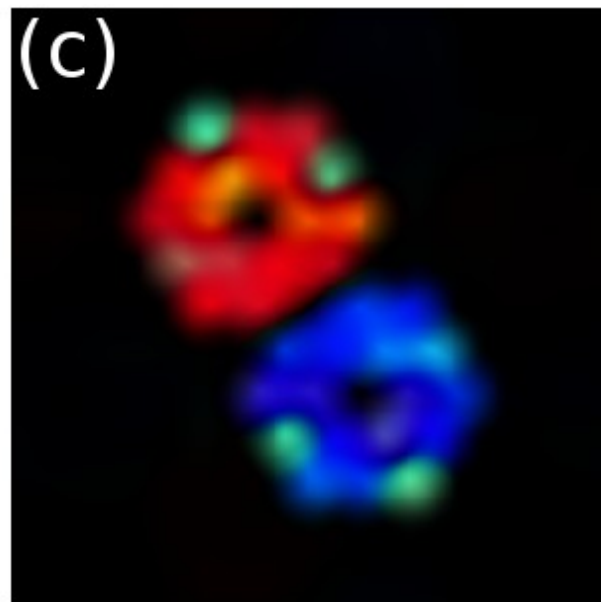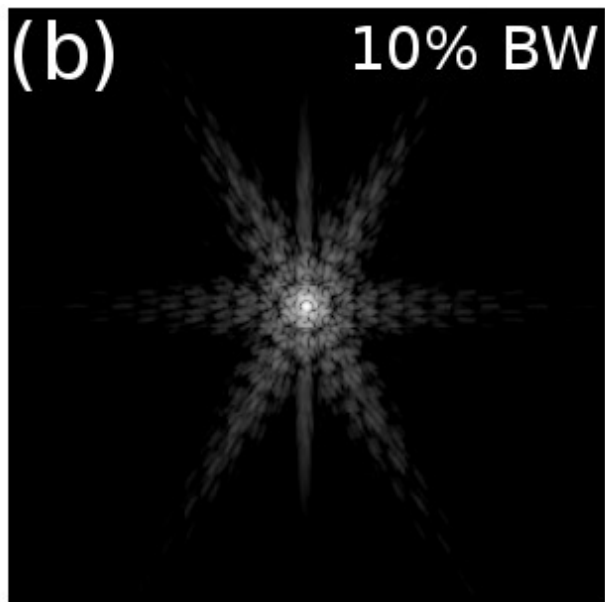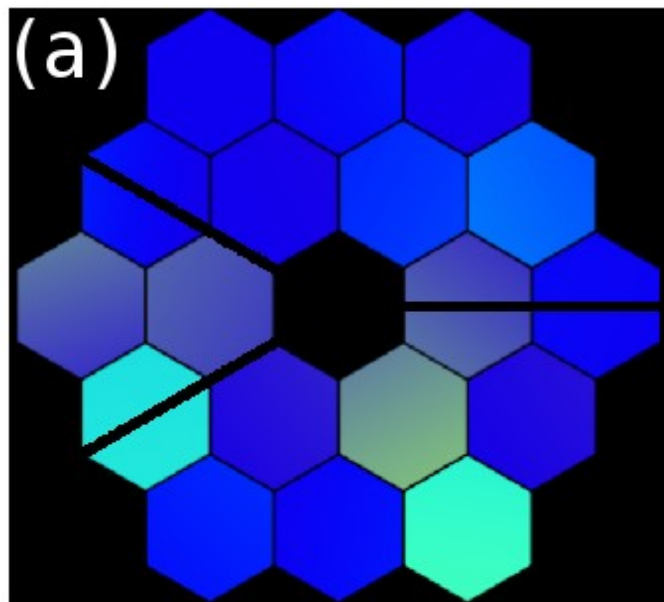
Effect of Modification Area
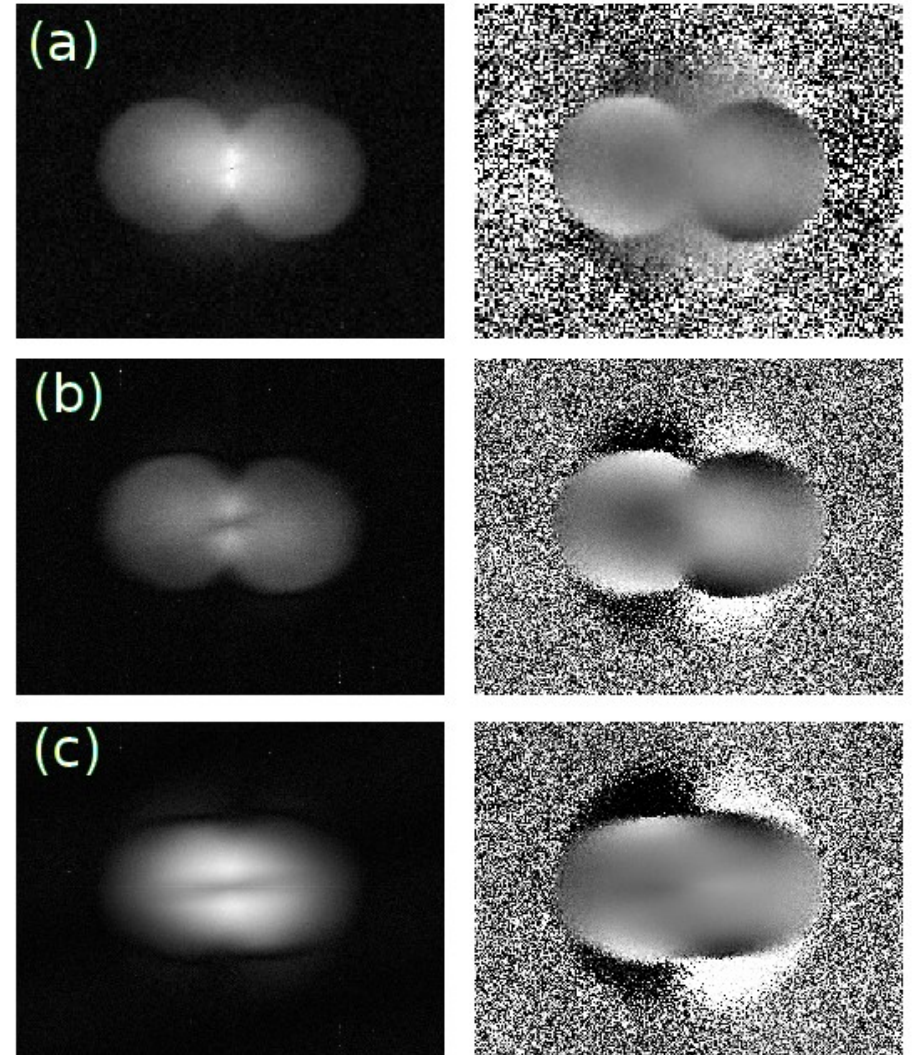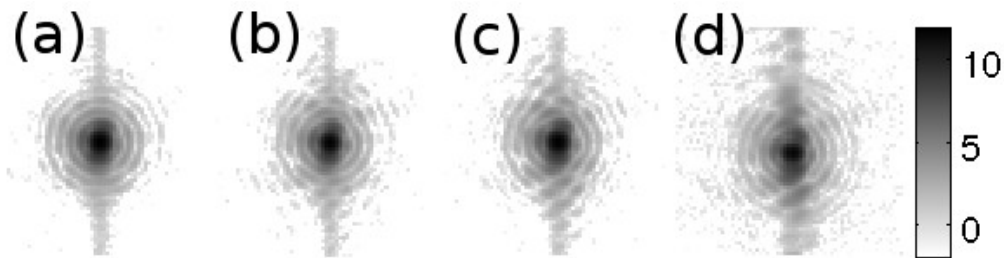
dOTF Deconvolution Experiments
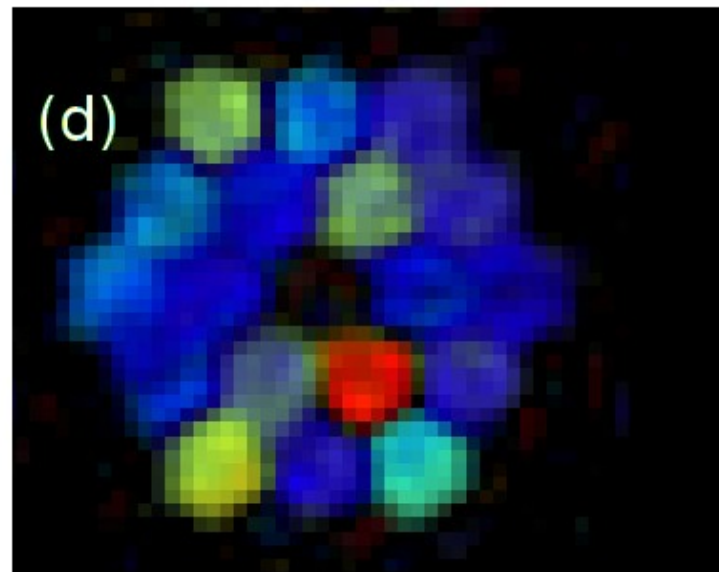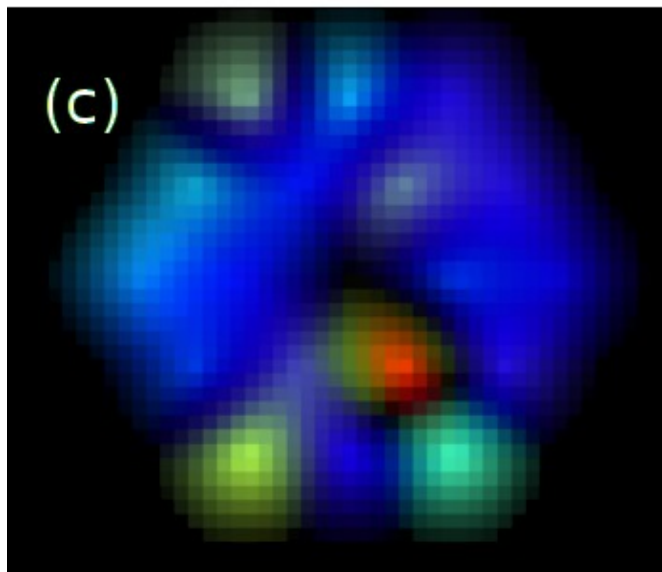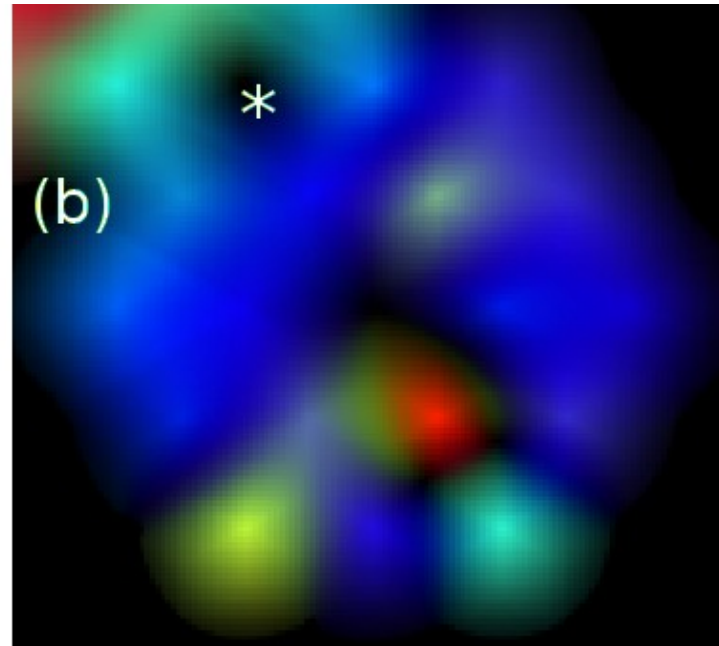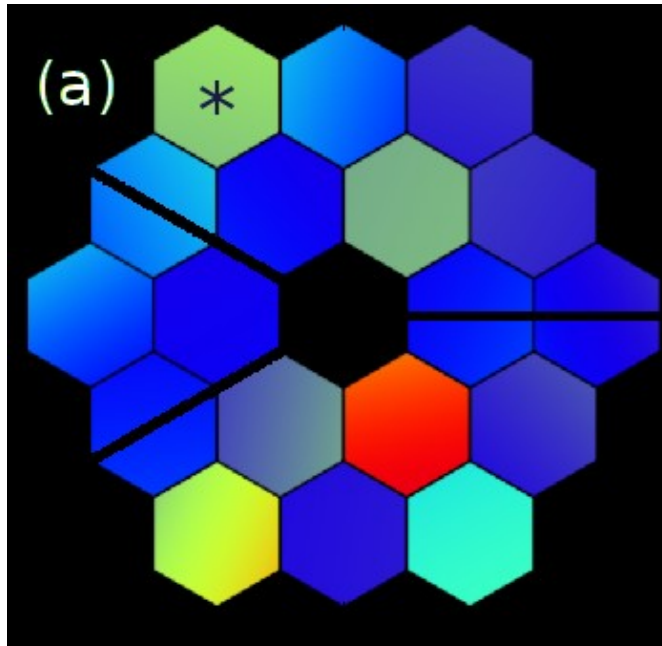
Effect of Bandwidth
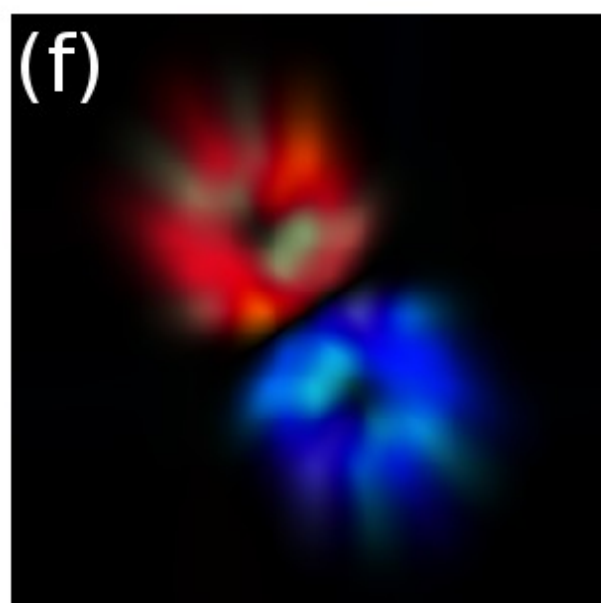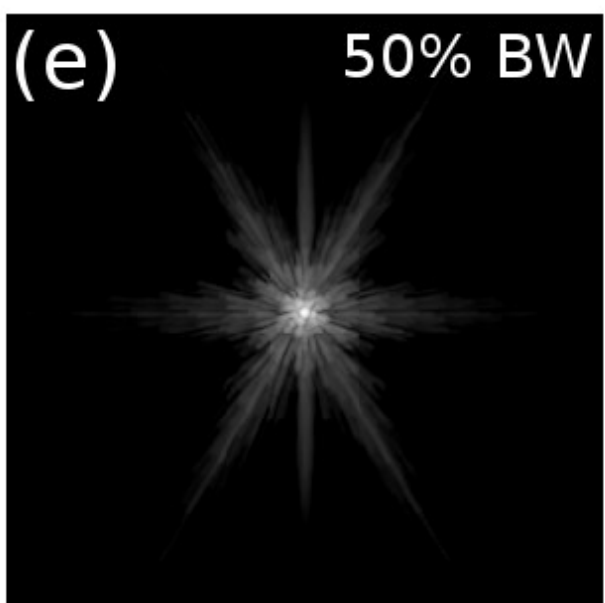
Effect of Photon Noise on dOTF
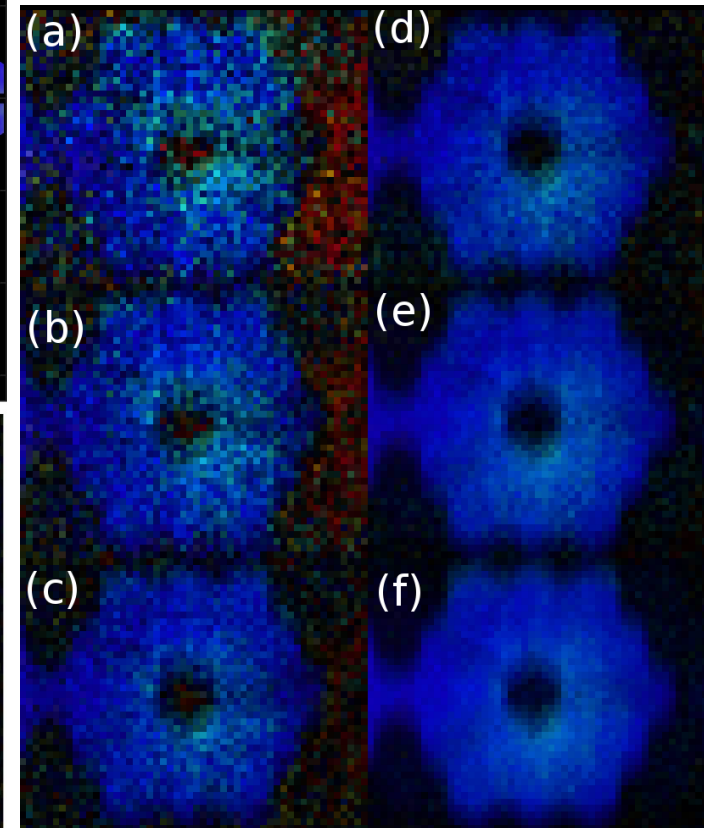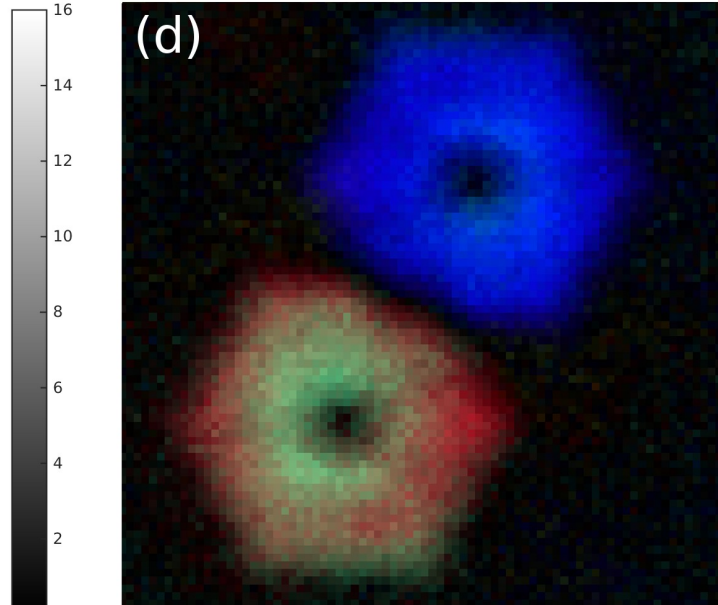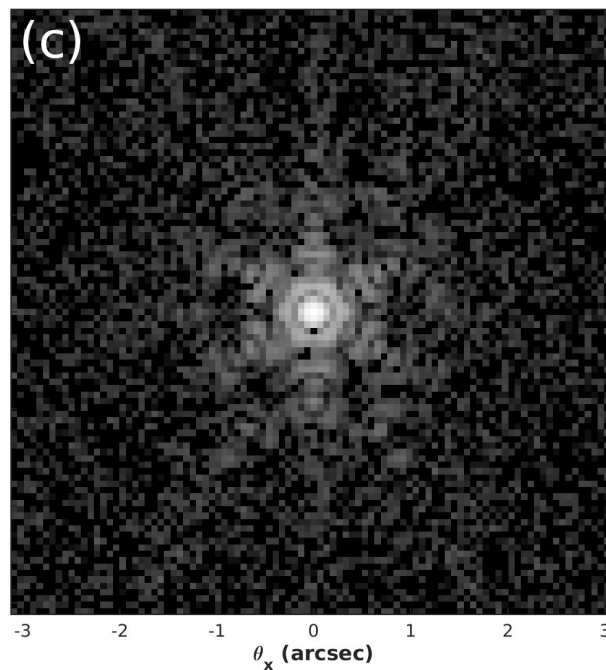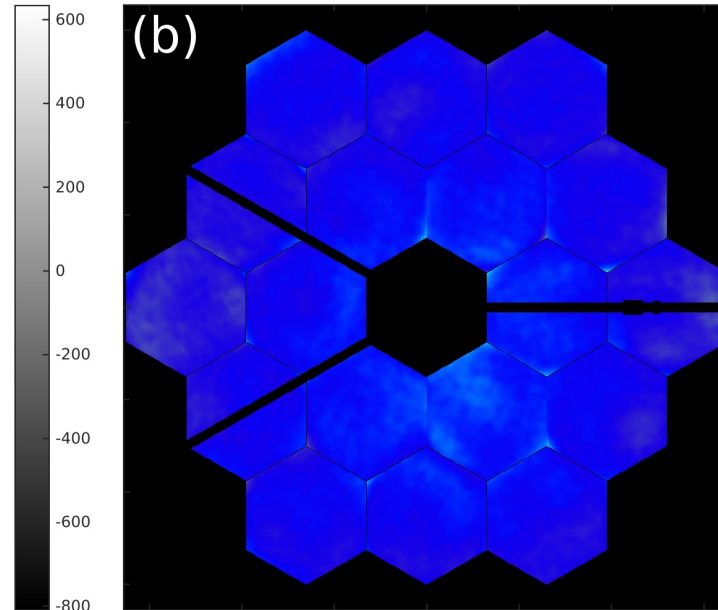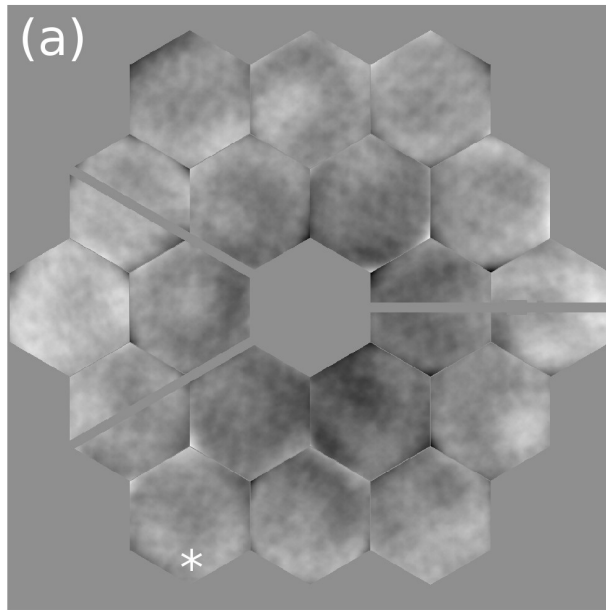
Spatial Correlation in dOTF Noise
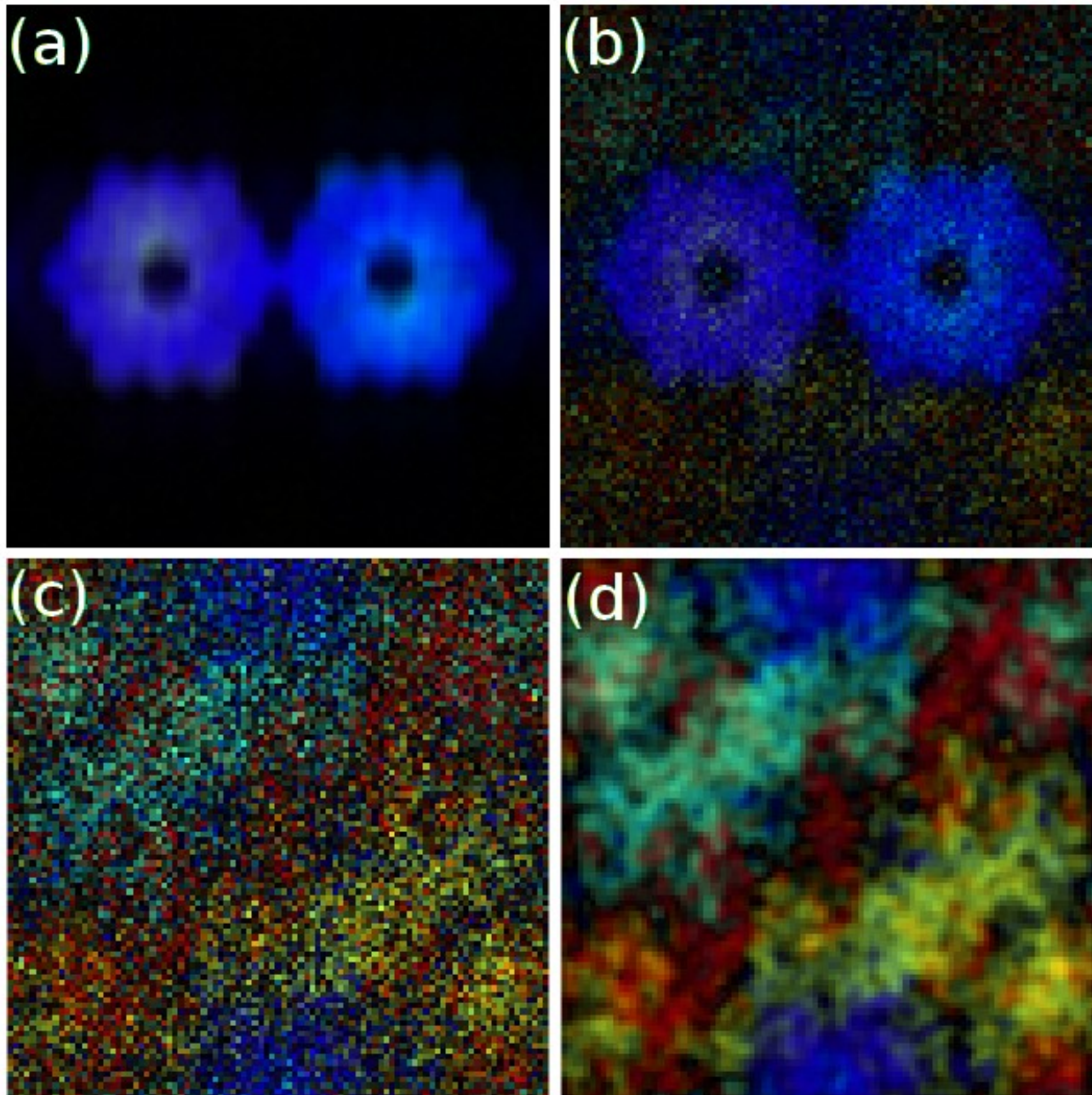
dOTF Deconvolution

Phase Apodization Coronagraphs

Pupil Phase Patterns

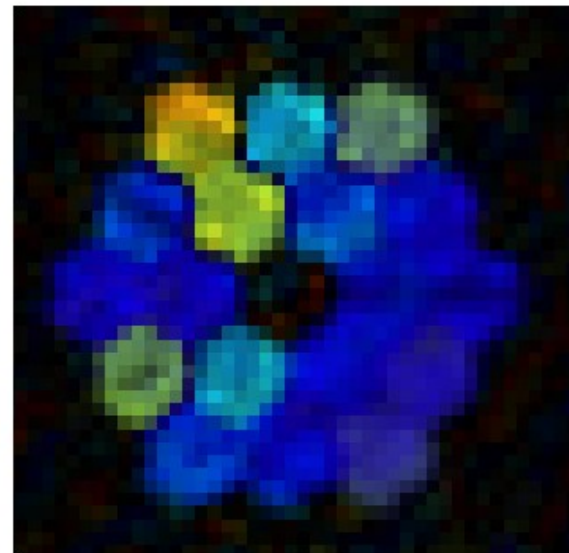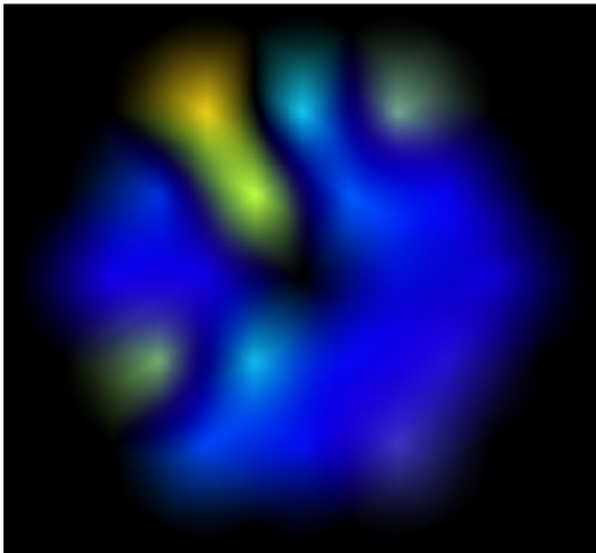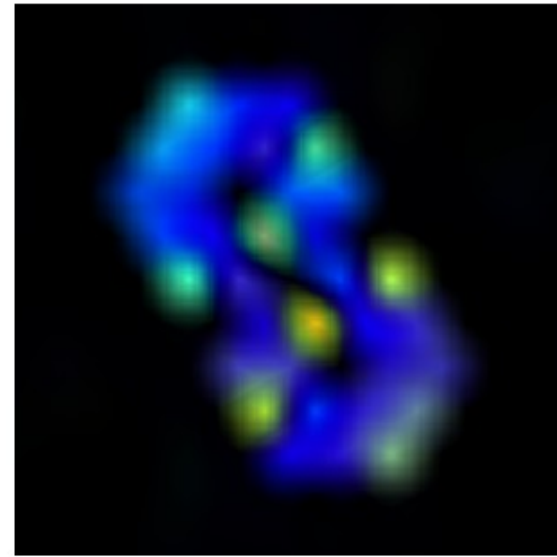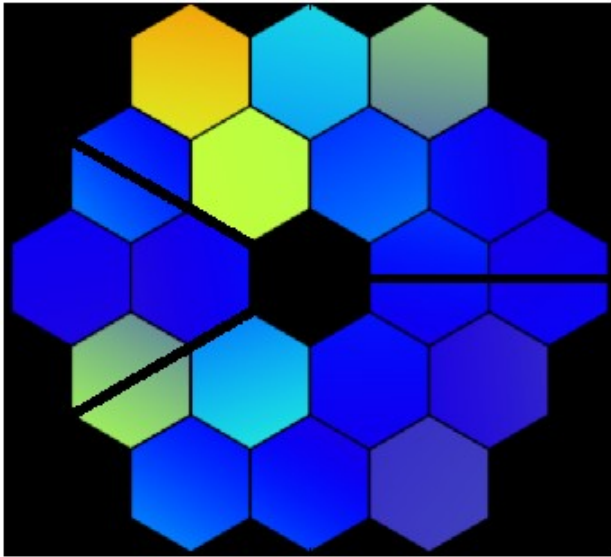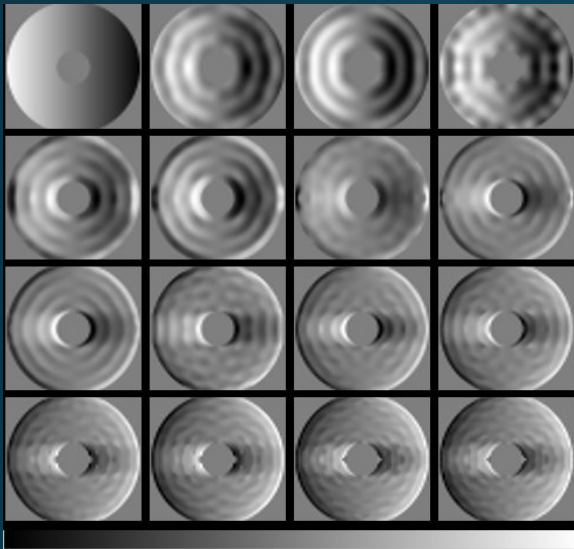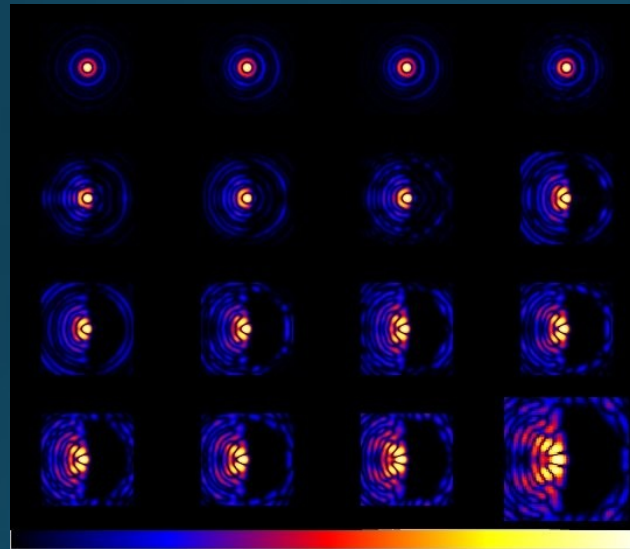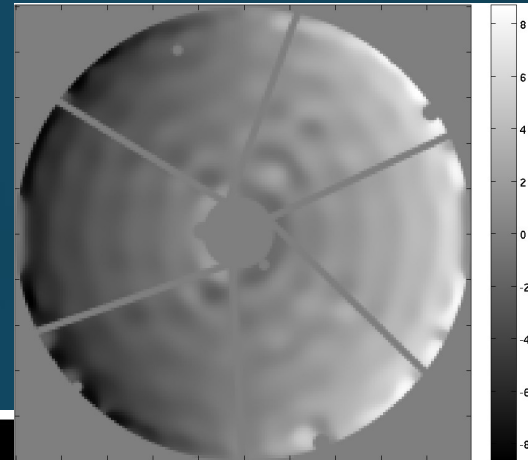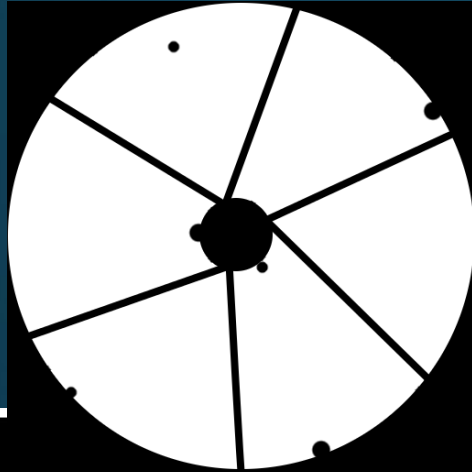**Corresponding PSFs**

Diamond-turned Apodizing Phase Plate (APP)

We could also use a deformable mirror (DM) to apply this phase pattern. One MEMS DM would replace multiple diamond-turned APPs and provide many programmable benefits.
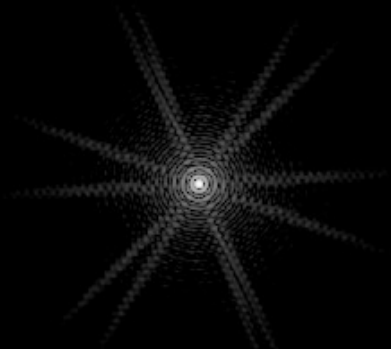
PAC for Arbitrary Pupil Shapes
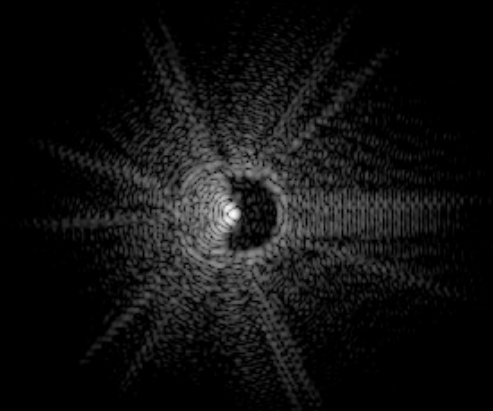

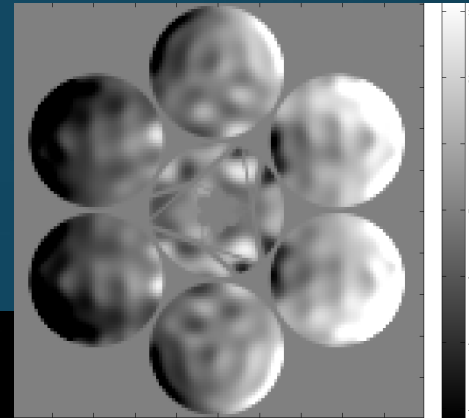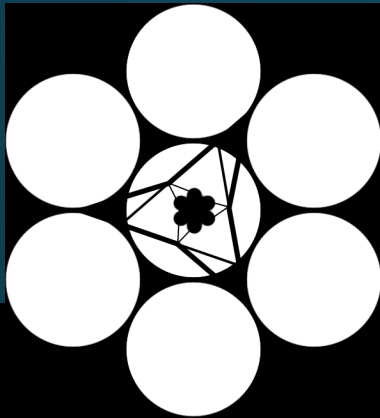Hypothetical Pupil

Pupil Phase Pattern
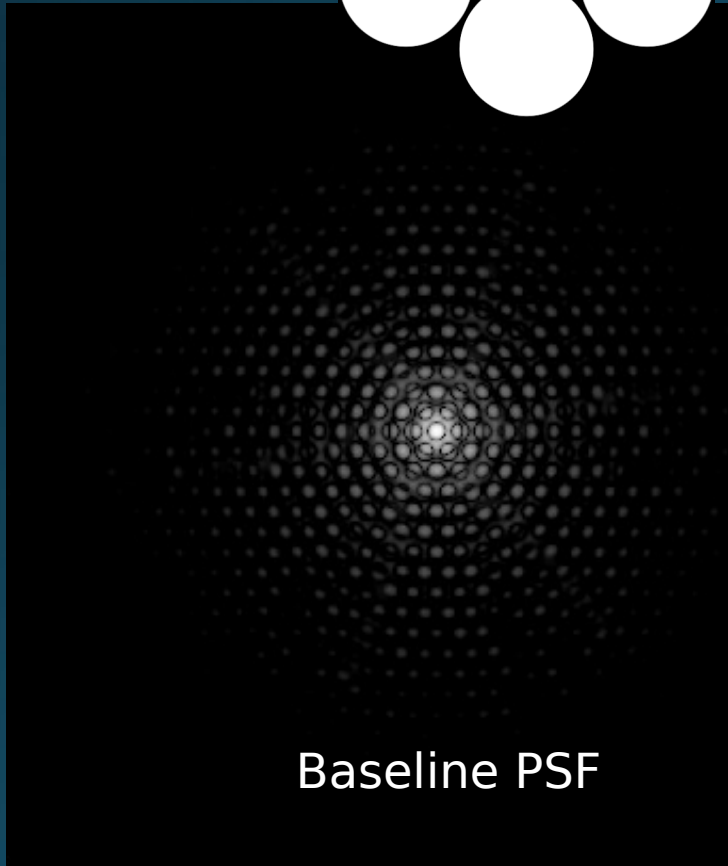
Baseline PSF

Phase Apodized PSF

PAC for the GMT

GMT Segmented Pupil

Typical Phase Apodization Pattern

Baseline PSF

Phase Apodized PSF